U.S. Fish and Wildlife Service
Office of Subsistence Management
Fisheries Resource Monitoring Program

Abundance and run timing of adult salmon in the Kateel River, Koyukuk National Wildlife Refuge, Alaska 2001

Annual Report No. FIS01-038-1

This report has been prepared to assess project progress. Review comments have not been addressed in this report, but will be incorporated into the final report for this project.

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Annual Report Summary Page

Title: Abundance and run timing of adult salmon in the Kateel River, Koyukuk National Wildlife Refuge, Alaska 2001.

Study Number: FIS01-038-1

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Management Regions: Yukon River

Information Type: Stock status and trends of chinook and chum salmon

Issues(s) Addressed: The abundance and run timing of spawning populations of salmon within the Yukon River drainage is one of many issues identified specifically by the Regional Advisory Councils and the Yukon River Comprehensive Management Plan for Alaska. While there has been an increase in escapement data from the Koyukuk River drainage in recent years, many tributaries remain unstudied. The escapement numbers from this study will assist in providing in-season information for managers and allow for post-season evaluation of management practices and future run projections.

This project attempted to identify spawning populations within the Kateel River drainage but unfortunately, due to unforseen complications the weir was not installed and operational during the 2001 field season. Specifically if data were collected, it would have addressed issues of run size, timing and composition, age, sex, and length of spawning salmon. Also, the information that would have been collected would have attempted to close the information gaps between projects along the Koyukuk River.

Study Cost: $245,210.00 **Study Duration:** May 2001 to March 2004

Key Words: subsistence fishery, chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, Yukon River drainage, Koyukuk River, Kateel River, spawning adults, stock status/trends, escapement, resistence board weir.

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Table of Contents

Introduction

Chinook *Oncorhynchus tshawytscha* and chum *O. keta* salmon spawning in the Kateel River contribute to the subsistence and commercial fishery within the Yukon River drainage. Chinook salmon enter the Yukon River in mid June and continue through early July. Summer chum salmon enter the Yukon River in mid June while fall chum salmon enter in late July early August. Spawning chinook salmon utilize tributaries along the entire Yukon River while the summer chum salmon utilize those tributaries along the lower and middle areas of the Yukon River. Recent declines of Yukon River salmon stocks, particularly summer and fall chum salmon (Bergstrom et al. 1995; Kruse 1998), have led to harvest restrictions, complete fishery closures, and spawning escapements below management goals. Accurate escapement estimates are required to determine the exploitation rates, marine survival, and spawner recruit relations of Pacific salmon stocks (Labelle 1994). In addition adequate escapements to individual tributaries and main stem spawning areas are required to maintain genetic diversity and sustainable harvests, but management is complicated by the mixed stock nature of the Yukon River fishery (Tobin and Harper 1998).

Historically the Alaska Department of Fish and Game-Division of Commercial Fisheries (ADF&G-DCF) has conducted and compiled a database on relative abundance of salmon stocks from many tributaries in interior Alaska. This database is primarily made up of aerial surveys (Barton 1984), which are highly variable and are an index of relative strength. More in-depth studies along the lower Yukon River provide managers with information required to assess the run in-season (Vania and Golembeski 2000). These studies include the Emmonak test fishery, reports from subsistence and commercial harvests, Pilot station sonar, East Fork Andreafsky River weir. In addition there are studies along the middle portion of the Yukon River that record stock status and trends of various salmon and resident species. These are the pilot radio telemetry study on the Innoko River, the Anvik River sonar study, the Gisasa River weir, the Clear Creek-Hogatza River counting tower, and the Henshaw Creek weir. The results from these escapement and distribution projects which are conducted throughout the Yukon River drainage each year provide managers with an indication of run strength for chinook and chum salmon stocks.

The Koyukuk National Wildlife Refuge (Refuge) is located on the lower Koyukuk River near the villages of Koyukuk, Galena, Huslia, and Hughes. The residents of these villages depend on both salmon species for subsistence use. In accordance with the Alaska National Interests Lands Conservation Act of 1980 the Refuge was established to conserve fish and wildlife populations and habitats in their natural diversity, to fulfill treaty international treaty obligations, and to provide the opportunity for continued subsistence uses by local residents (USFWS 1993). Obtaining accurate escapement and stock assessment estimates from adult salmon are important components in refining fishery management practices and fulfilling Congressional mandates. The first step in collecting this type of information within the Refuge was to install a resistance board weir (Tobin 1994) on the Gisasa River (Melegari and Wiswar 1995) in 1994.

Monitoring escapement with counting towers and fish weirs provides accurate information for evaluation of management practices. Stock status and escapement projects conducted in the Koyukuk River drainage to enumerate salmon stocks are the Gisasa River weir (1994-2001), South Fork Koyukuk River weir (1996-1997), and Clear Creek counting tower (1995-2001), Henshaw Creek counting tower (1999), and Henshaw Creek weir (2000-2001).

The Kateel River is one of many tributaries flowing into the Koyukuk River drainage on the Koyukuk National Wildlife Refuge. The upper reaches of Kateel River, as well as other tributaries of the Koyukuk River provide spawning and rearing habitat for chinook and chum salmon (USFWS 1993). Aerial survey estimates for escapement in the Kateel River have ranged from one to 185 chinook and six to 4,276 chum salmon (Barton 1984; ADF&G, unpublished data). The Kateel River has been classified as a secondary index stream for chinook and chum salmon (ADF&G 1998). Biological information from both salmon species can be collected from this system which meets issues identified by the Regional Advisory Councils and stated in the Yukon River Comprehensive Management Plan for Alaska. While there has been an increase in escapement data from the Koyukuk River drainage in recent years, many tributaries remain unstudied. The escapement estimates from this study will assist in providing in-season information for managers and allow for post-season evaluation of management practices and future run projections. The objectives of the Kateel River weir were to: 1) determine daily escapement and run timing of adult salmon. 2) determine age, sex, and length compositions of adult salmon, and 3) determine the movement of resident fish as they moved upstream.

Study Area

The Kateel River is a small clear water tributary of the Koyukuk River in north-central Alaska (Figure 1). The headwaters of the Kateel River drains the western and northern areas of the Refuge and are located in the Nulato Hills (USFWS 1993). The climate characteristics of this area is cold and continental, which is characterized by extreme seasonal temperature variations and very low precipitation. There is a extreme range in air temperature with recorded temperatures of 32° C in summer months to lows of -59° C in winter months (USFWS 1993). Stream flows are highest during the spring months in response to snow melt with sporadic high discharge periods throughout the summer months in response to local rain showers (USFWS 1993).

Channel configuration is typically meandering with alternating cut banks and gravel bars. The substrate varies from gravel and cobble in high velocity areas to mud and silt in eddies and sloughs. Lower stream channel are more uniform in appearance with gradual sloping mud banks and emergent shoreline vegetation (USFWS 1993). The weir site is approximately 47 km upstream from the mouth of the Kateel River. The width of the channel at the weir site averages 31 m with an average depth of 0.6 m. Substrate at the weir site is made up of medium-large (25-75 mm) size gravel.

Methods

Weir Operation.—A resistence board weir was supposed to be operated to collect biological information from adult salmon and resident species as they migrated up the Kateel River. Construction and installation of the weir was described by Tobin (1994). Each picket of the weir was schedule 40 polyvinyl chloride (PVC) electrical conduit with a 2.5 cm inside diameter and spaced 3.2 cm apart between individual pickets (Wiswar 2001). Upon completion of the weir, visual inspection of the weir was to be conducted on a daily basis for holes and structural integrity. During visual inspection the weir was to be cleaned of debris and fish carcasses. The weir site is 47 km from the confluence to the Koyukuk River. A live trap to be installed near mid-channel would allow

salmon and resident species to pass upstream.

Biological Data.—Run timing and abundance of adult salmon were to be estimated by recording and plotting the number of each species of fish migrating through the weir each day. Daily counts would have begun at 0001 hours and ended at midnight. A four-person crew would have split the 24-hour time frame into four different counting periods. The trap would have been opened at the top of the hour and fish species would have been counted and recorded throughout that hour.

A stratified random sampling scheme was to be used to collect age, length and sex ratio information from both adult salmon species. Calculations for sex and age information were to be treated as a stratified random sample (Cochran 1977) with statistical weeks as the strata. Each statistical week was defined as beginning on Monday and ending on Sunday. Sampling would have started at the beginning of each week and would generally be conducted over a 3-4 day period to collect the targeted 160 fish/species. Daily sex ratios were to be collected using two methods: 1) sex would have been recorded when sampling for age and length, and 2) salmon would have been sexed during counts throughout the day. For sex ratios collected throughout the day crew members physically handled and sexed the fish as they migrated into the trap. Scale samples would have been used for ageing salmon and reported using the European technique (Foerster 1968). Three scales would have been collected from chinook samples and one scale from chum salmon. Scales would have been sampled from the area located on the left side of the fish and two rows above the lateral line on a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Scales from both adult salmon species would have been sent to ADF&G-DCF for processing. Lengths of chinook and chum salmon would have been measured to the nearest 5 mm from mid eye to fork of the caudal fin (MEL).

Data Analysis.—Within a week, the proportion of the sample composed of a given sex or age, p_{ij}, would have been calculated as

$$p_{ij} = \frac{n_{ij}}{n_j},$$

where n_{ij} is the number of fish by sex i or age i sampled in week j, and n_j is the total number of fish sampled in week j. The variance of p_{ij} would have been calculated as

$$v(p_{ij}) = \frac{p_{ij}(1 - p_{ij})}{n_j - 1}.$$

Sex and age compositions for the total run of chinook and chum salmon of a given sex/age, p_i, would have been calculated as

$$p_i = \sum_{j=1} W_j p_{ij},$$

where the stratum weight (W_j) would have been calculated as

$$W_j = \frac{N_j}{N},$$

and N_j equals the total number of fish of a given species passing through the weir during week j and N is the total number of fish of a given species passing through the weir during the run. Variance of sex and age compositions for the run would have been calculated as

$$v(p_i) = \sum_{j=1} W_j^2 v(p_{ij}).$$

Results

Weir operation.—The weir was not installed during the 2001 field season.
Biological data.—There was no biological information collected from both salmon species and resident species.

Discussion

Weir operation.—Due to transportation and staffing problems the weir was not installed and operational during the 2001 field season. The schedule for transporting the materials and supplies to the study site was not followed due to unforseen problems.

One of the problems to cause a dely involved the timing of the barge used to ship the materials and supplies. It was planned to have the materials and supplies shipped by June 18. Due to a late breakup the barge was behind schedule in making trips to villages on the Yukon River. During breakup there were ice jams which caused flooding of several villages along the Yukon River. These high water levels and floating debris caused the departure of the barge to be delayed two weeks, until June 30. The materials and supplies arrived at the mouth of the Kateel River on July 4.

The second problem to cause a involved the use of the Bureau of Land Management-Alaska Fire Service helicopter. Using the investigational plan, it was intended to use the helicopter during the week of June 25-29 to ferry materials and supplies from the mouth of the Kateel River to the study site. Due to the late arrival of the materials and supplies at the mouth of the Kateel River, the use of the helicopter was pushed back to the week of July 2-7. On July 5 the helicopter made several trips from the mouth to the study site. Unfortunately the helicopter was called to a small fire south of Galena on July 6 which caused the use of the helicopter to be delayed three days. All large materials and supplies were ferried to the study site by July 9. From July 10-11 the crew transported the remaining materials and supplies from the mouth to the study site by boat. On this date the project was approximately three week behind schedule.

The staffing problems that were encountered were due to one of the crew members quitting. The reduction in crew size, from four to three, made it difficult for construction and installation of the weir. A three person crew would have been able to install the weir but operation would have been delayed another two weeks. With further delay, it was anticipated that a higher percentage of both salmon runs would have passed making the weir counts less valuable.

Even though all materials and supplies were on site by July 11, there were difficulties with constructing the weir. These complications would have delayed the project another week, until July 18. Using historical results from other studies conducted on the Koyukuk River, Gisasa River and Henshaw Creek weirs, a major proportion of both salmon runs had migrated through the weirs. For example, since the start of the Gisasa River weir in 1994 the proportion of chinook migrating through the weir ranged from 26% to 97% with an average of 85% by July 18 (Wiswar 2001). In addition, in 2000 the Henshaw Creek weir recorded 43% of the chinook and 35% of the chum salmon migrating through the weir on this date. This is important information because the Kateel River is located between these two systems. The Gisasa River is 67 km downstream and Henshaw Creek is 315 km upstream of the Kateel River (Figure 2). With the additional time needed to install and make the weir operational it appeared that at least 50% of both salmon runs would have passed the study site. Due to such a high percentage of both salmon runs migrating past the study site, it was decided to terminate the project and direct efforts toward preparing the study site for operation in 2002.

Recommendations

- Due to the remote location of the study site, it is recommended that the crew be sent to the study site earlier in the 2002 field season. An early start up date is necessary in case problems arise during installation.

- Transporting material, supplies, and personnel to the study site was a hindrance to construct and install the weir. Therefore it is recommended that the study site be moved farther downstream The 2001 crew leader has picked out a site that is closer to the mouth and is in an area that would eliminate any logistical problems.

- A major problem during the 2001 field season was high water, therefore it is recommended that a contingency project be included in the investigational plan that would still allow collection of biological information from salmon. Age, sex, and length information will be collected by the crew using a seine net to capture migrating salmon.

- It is recommended that during construction and installation of the weir the crew size be increased to 4 people to ensure the weir is operational before the start of the salmon run.

Acknowledgments

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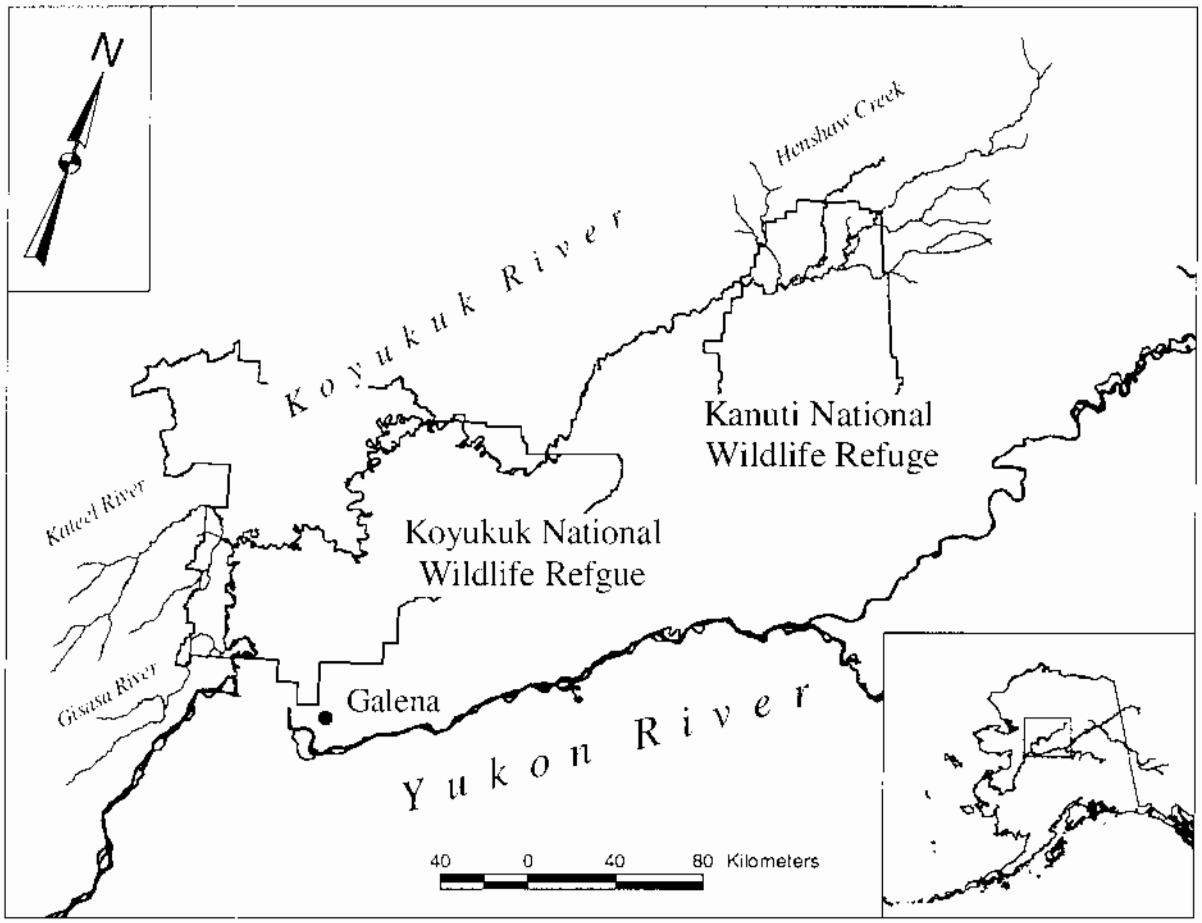

Figure 1.—Location of Gisasa River, Kateel River, Koyukuk National Wildlife Refuge, and Henshaw Creek, Kanuti National Wildlife Refuge, Alaska, 2001.